UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/528,253	03/17/2000	Kaori Fujimura	10746/17	4420

26646	7590	11/06/2003

KENYON & KENYON
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER
AKHAVANNIK, HUSSEIN

ART UNIT	PAPER NUMBER
2621	

DATE MAILED: 11/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	09/528,253	FUJIMURA ET AL.
	Examiner	Art Unit
	Hussein Akhavannik	2621

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6-10,12-26,28,29,31-38 and 40-54* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *3 and 33* is/are allowed.

6)☒ Claim(s) *1-2,4,6-10,12-26,28,29,31-32,34-38 and 40-54* is/are rejected.

7)☒ Claim(s) *23* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 March 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

    If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☒ All b)☐ Some * c)☐ None of:

      1.☒ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____ .

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

    a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .

4)☐ Interview Summary (PTO-413) Paper No(s). _____ .
5)☐ Notice of Informal Patent Application (PTO-152)
6)☐ Other: .

DETAILED ACTION

Response to Arguments

1.   Applicant's arguments with respect to claims 1-4, 6-10, 12-26, 28-29, 31-38, and 40-54

have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

2.   Claims 3 and 33 are allowed.

3.   The following is a statement of reasons for the indication of allowable subject matter:

The prior art fails to teach or suggest the features of providing n different channels for a signal x

which has 128 * n stages in context of the position correction of a projection image recited in the

independent claims 3 and 33.

Specification

4.   Claim 23 is objected to because it is explained to be cancelled in page 24 of the

amendment filed September 22, 2003, but is not cancelled in the listing of the claims on page 10.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

5.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

6.   Claims 1, 24, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu

et al (U.S. Patent No. 6,363,163) in view of Liu et al (U.S. Patent No. 6,023,635).

Referring to claim 1, which is representative of claims 24 and 31,

i. Inputting first tomographic images and second tomographic images is explained by Xu et al in column 4, lines 58-66. The sets of data are obtained through tomography scans and are taken at different times.

ii. Generating a first projection image from the first projection images and a second projection image from the second tomographic images is not explicitly explained by Xu et al. However, Liu et al explain in column 1, lines 14-21 that in the field of computer tomography, projection images are especially useful for screening vascular morphology and pathological diseases. Detecting such diseases is also the goal of the computed tomography system of Xu et al wherein interval changes are analyzed for change in tumors size or newly developed pleural effusion as explained in the abstract. Liu et al also explain that radiologists prefer viewing projection images rather than slice images in analyzing medical images in column 1, lines 20-21. Thus, the multiple slice images of Xu et al, which are perpendicular to the z-axis as illustrated in figures 2A and 2B, can be replaced by a projection image as suggested by Liu et al in order to reduce the number of images being viewed by the radiologist. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to generate a projection image from a series of slice image constituting a tomographic image set in order to represent the image set in a more compact and preferred means.

iii. Measuring the shift amount between the first projection image and a second projection image by searching the second for the same area as a template generated from the first projection image is explained by Xu et al in column 7, lines 35-52 and illustrated in figure 6C for the X-axis and Y-axis correction and column 6, lines 27-52 for the Z-axis

direction . The use of a template from the first projection data is explained by Xu et al in

column 7, line 63 to column 8, line 9, the claimed template corresponding to Xu et al's

"previous section image" and the claimed shift amount corresponding to Xu et al's ΔX

and ΔY at column 8, lines 6 and 36.

iv.   Correcting the slice position according to the shift amount between the first

projection image and the second projection image is explained by Xu et al in column 8,

lines 44-64.

v.   Displaying the diagnostic image and the comparison image at a corrected slice

position is explained by Xu et al is illustrated by Xu et al in figure 13 as the output device

(105). Xu et al explain that this device could be a display in column 10, lines 30-32. The

display is apparent as well in Xu's drawings. For example, see figures 2A-2B and 6A-

6C.

7.   Claims 2, 4, 6, 10, 16-19, 25-26, 28-29, 32, 34, 38, 44-47, and 50-54 are rejected under

35 U.S.C. 103(a) as being unpatentable over Xu et al in view of Liu et al, and further in view of

Some et al (U.S. Patent No 5,841,148).

Referring to claims 2, 6, 25, 28, 32, and 34, all the limitations of these claims correspond

to claim 1, except:

i.   Aligning the resolutions of the first tomographic images and the second

tomographic images by scaling one or both of the tomographic images when the

resolutions of the tomographic images are different is not explained by Xu et al or Liu et

al. However, Some et al do explain an image processing apparatus to enlarge or reduce

images in column 13, lines 39-61. Some et al perform the magnification correction (200)

before performing the template matching (202) between a first image and a second image

to find a region of interest, as illustrated in figure 6. A magnification correction would be

necessary to improve the probability of finding a template of a certain resolution in

another image, which could be at a different resolution. Therefore, it would have been

obvious to one of ordinary skill in the art at the time the invention was made to align the

resolution of the first and second tomographic images by scaling the one or both of the

images when the resolutions of the two images are different so that the probability of

detecting the template in a second image is increased resulting in more accurate shift

measurements.

ii.   Measuring the shift amount between the first projection image and a second

projection image by searching the second for the same area as a template generated from

the first projection image by pattern matching while shifting the template by an interval is

explained by Xu et al in column 7, lines 35-52 for the X-axis and Y-axis correction and

column 6, lines 27-52 for the Z-axis direction. The use of a template from the first

projection data and using cross-correlation matching to find the highest correlation point

between the template and the second image group is explained by Xu et al in column 7,

line 63 to column 8, line 9.

Referring to claims 4, 10, 26, 29, and 38, all of the limitations of these claims correspond

to claims 2, 6, 25, 28, 32, and 34, except:

i.   Generating a first projection image of the X axial direction from the first

tomographic images and generating a second projection image from the second

tomographic images is explained by Xu et al in column 5, lines 1-7. The reconstructed

tomographic data is three-dimensional so it may be reconstructed in the X, Y, or Z axial

direction. Once the data is reconstructed, then projection (or section) images may be

taken in any direction as illustrated by Xu et al in figures 2A-2B for the Y-axis.

Referring to claims 16, 17, 44, and 45, generating the projection images in which a

weight is assigned to the specific observation object by setting a window level and a window

width is not explicitly explained by Xu et al or Liu et al. However, Some et al do explain an

image data selection unit (68) that is capable of selecting a part of image data stored in memory

in column 9, line 53 to column 10, line 20. This selected image data can then be processed for

magnification correction and then position correction. By selecting only a portion of the

projection image in memory, Some et al are assigning a weight of one to the selected window

and a weight of zero to the addition portions of the image. By selecting only a portion of the

projection image, computation necessary for position correction can be reduced. Therefore, it

would have been obvious to one of ordinary skill in the art at the time the invention was made to

select a window of the projection image by assigning weights to the original projection image.

Referring to claims 18, 19, 46, and 47, generating the projection images in which only a

part including the distinctive part is projected is not explicitly explained by Xu et al or Liu et al.

However, Some et al do illustrate projection images in which only the distinctive part is included

in figure 4. By selecting only the distinctive part of the projection image, computation necessary

for position correction can be reduced while the result of the template search would not suffer.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention

was made to generate a projection image in which only the distinctive part is projected to reduce

computation time and/or processing power.

Referring to claims 50-54, finding a reference position in the Y-axial direction from the

first and second tomographic image and correcting the shift in the Y axial direction on the basis

of the reference position is illustrated by Xu et al in figure 6C. The reference position are

illustrated in figure 4A and explained in column 7, lines 1-14 as the regions of interest, which are

clearly in the Y-axial direction.

8.   Claims 7-8, 12, 35-36, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Xu et al, Liu et al, and Some et al as applied to claims 2, 4, 6, 10, 16-19, 25-26, 28-29, 32,

34, 38, 44-47, and 50-54 above, and further in view of Moshfeghi (U.S. Patent No. 5,368,033).

Referring to claims 7 and 35, generating the projection image comprising of pixel values

obtained by adding pixel values obtained by adding pixel values of the tomographic images in

the X or Y axial direction or in any other direction is not explicitly explained by the systems of

Xu et al or Liu et al or Some et al. Though Liu et al do explain using Maximum Intensity

Processing (MIP) to determine the projection image, they do not explain summing the pixel

intensities of the multiple slice images. However, Moshfeghi does explain generating projection

images of a blood vessel by summing the intensities of the voxels (three-dimensional pixels) in

the viewing direction in column 9, lines 14-26 and illustrated in figure 2. The images of the

blood vessel in figure 2 are obtained tomographic magnetic resonance techniques, which are

analogous to the CT scanning of this application. The projection image created by Moshfeghi

illustrates the thickness and overlap of the vessels that have been imaged. Such information

would be obvious to use in the system of Xu et al, Liu et al, and Some et al to better define the

reference positions used to align the two projection images. Therefore, it would have been

obvious to one of ordinary skill in the art at the time the invention was made to create a

projection image by adding pixel values of tomographic images in any direction so that the

reference positions used to determine the shift amounts are better defined.

Referring to claims 8, 12, 36, and 40, all the limitations of this claim correspond to claim

7, except:

     i.   Generating a projection image by interpolating the two-dimensional image is not

explicitly explained by the systems of Xu et al or Liu et al or Some et al. However,

Moshfeghi explains interpolating images to create projection images in column 9, lines

14-26. Moshfeghi explains that interpolating the images would be beneficial when the

parallel rays do not pass precisely through the center of the voxels to resample the

volumetric image to determine new voxel centers. Therefore, the interpolation would

align the parallel slice image sequence to create an accurate projection image. Therefore,

it would have been obvious to one of ordinary skill in the art at the time the invention was

made to generate a projection image by interpolating a two-dimensional image sequence

so that the projection images are created more accurately, resulting in a more accurate

shift measurement.

9.   Claims 9, 22, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu

et al, Liu et al, and Some et al as applied to claims 2, 4, 6, 10, 16-19, 25-26, 28-29, 32, 34, 38,

44-47, and 50-54 above, and further in view of Jang et al (U.S. Patent No. 5,862,249).

Referring to claims 9, 22, and 37, the template being an area of 25% to 50 % from the top

of the first projection image in the Z axial direction is not explained by the systems of Xu et al or

Liu et al or Some et al. However, Jang et al do illustrate four horizontal strip regions that are

used to extract certain features from in figure 7a. Jang et al explain that the regions Rh3 and Rh4

have the same width and regions Rh1 and Rh2 have the same width in column 6, line 63 to column 7, line 4. Therefore, by setting the widths of the four regions equal to each other is would be possible to use an area 25% to 50% from the top of the first projection in the X axial direction as the template. The system of Jang et al then performs position correction similar to the system of Xu et al, Liu et al, and Some et al. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a template to be an area 25% to 50% from the top of the first projection image in the Z axial direction to reduce the computation necessary to search for a template.

10.   Claims 13-15, 20-21, 41-43, and 48-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al, Liu et al, and Some et al as applied to claims 2, 4, 6, 10, 16-19, 25-26, 28-29, 32, 34, 38, 44-47, and 50-54 above, and further in view of Kano et al (U.S. Patent No. 5,359,513).

Referring to claims 13 and 41,

i.   Extracting a bed area as the reference position from the first tomographic image and second tomographic image in not explained by the systems of Xu et al or Liu et al or Some et al. However, Kano et al do explain using the mediastinum as a region of interest to align to images in column 6, lines 12-19. Kano et al go on explain that the mediastinum is the white area near the center of the chest due to the spine and other related anatomical structures. The spine is surrounded by the backbone, so it would be included as part of the mediastinum according to the definition of Kano et al. The mediastinum is located in the bed area, as it has been imaged. Therefore, it would

obvious to one of ordinary skill in the art at the time the invention was made to use the

bed area as the reference position from the first tomographic image.

ii.   Correcting the shift in the Y axial direction on the basis of the bed surface, the Y-

axis being perpendicular to the bed surface is not explained by the systems of Xu et al or

Liu et al or Some et al. However, Kano et al explain calculating the shift of an image in

the Y axial direction in column 9, lines 14-26 and illustrate the calculation in figure 5. In

figure 5, the Y axial direction is perpendicular to the surface of the bed when the patient

is lying of his/her back. Therefore, it would have been obvious to one of ordinary skill in

the art at the time the invention was made to correct the shift in the Y axial direction on

the basis of the bed surface.

Referring to claims 14 and 42, these claims correspond to claims 13 and 41. The

mediastinum includes the backbone and spine, which are both body parts.

Referring to claims 15 and 43, these claims correspond to claims 13 and 41. The

mediastinum includes the backbone.

Referring to claims 20, 21, 48, and 49, generating a plurality of templates and performing

template matching on the second image by the plurality of templates is not explained by the

systems of Xu et al or Liu et al or Some et al. However, Kano et al do explain warping a second

image on the basis of local matching of a number of small regions of interest in column 5, line 60

to column 6, line 19. . Measuring the shift amount between the first projection image and the

second projection image from a plurality of reference points is explained by Kano et al in column

9, lines 14-26. It would be beneficial to use multiple templates (or ROIs) to improve the

accuracy of the alignment between the first and second projection image. Therefore, it would

have been obvious to one of ordinary skill in the art at the time the invention was made to use

multiple templates to correct the alignment between two projection images.

Conclusion

11.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure.

> Hibbard et al (U.S. Patent No. 6,266,453) – To exhibit autofusion of three-
>
> dimensional image data volumes in order to register the three-dimensional data as
>
> explained in the abstract.
>
> Moshfeghi (U.S. Patent No. 5,633,951) – To exhibit the words "projection" and
>
> "slice" being used interchangeably as explained in column 5, lines 11-13.
>
> Sidiropoulos et al (U.S. Patent No. 6,127,669) – To exhibit the words "projection"
>
> and "slice" being used interchangeably as explained in column 5, lines 18-21.

12.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Hussein Akhavannik whose telephone number is (703)306-4049.

The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Leo H. Boudreau can be reached on (703)305-4706. The fax phone numbers for the

organization where this application or proceeding is assigned are (703)872-9314 for regular

communications and (703)872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding

should be directed to the receptionist whose telephone number is (703)305-3900.

Hussein Akhavannik
October 22, 2003
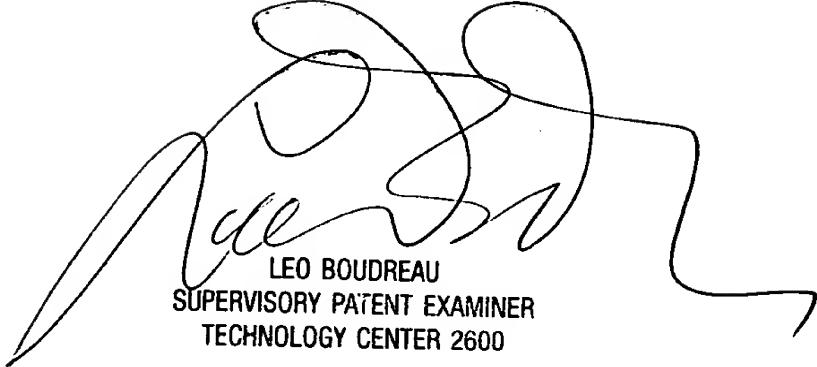
LEO BOUDREAU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600